Notice of Allowability	Application No.	Applicant(s)	
	09/544,390	HESS ET AL.	
	Examiner	Art Unit	
	Kandasamy Thangavelu	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *May 24, 2004*.

2. ☒ The allowed claim(s) is/are *36-45*.

3. ☐ The drawings filed on _____ are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☒ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☒ to Paper No./Mail Date *3*.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER

DETAILED ACTION

Introduction

1. This communication is in response to the Applicants' communications dated May 24, 2004. Claims 19-23, 33 and 34 were deleted. Claims 42-45 were added. Claims 36-45 of the application are pending.

Drawings

2. The drawings filed on April 6, 2000 are acceptable subject to correction of the informalities indicated on the "Notice of Draftperson's Patent Drawing Review," PTO-948, attached to Paper No. 3. In order to avoid abandonment of this application, corrections are required in reply to the Office action. The corrections will not be held in abeyance.

Reasons for Allowance

3. Claims 36-45 of the application are allowed over prior art of record.

4. The following is an Examiner's statement of reasons for the indication of allowable subject matter:

The closest prior art of record shows:

(1) a method and apparatus for optimizing plant process operations by improving feedforward plural variable control techniques; it initiates controller action based upon a prediction of the values of the controlled variables which are dependent on the input variables and manipulated variables; it introduces test disturbances in the manipulated variables and measures the effect on the controlled variables, so the response characteristics of the controlled variables can be predicted; the calculated values of the controlled variables are used to calculate new set of manipulated variables to minimize the error between the desired setpoint and the predicted future response of the process; the optimal control of the process is achieved by continuously simulating the process in the plant; the predictor uses linearized equations of the non-linear model (**Berkowitz et al.,** U. S. Patent 5,488,561);

(2) a method for estimation of the state variables of non-linear systems with exogenous inputs based on extended Kalman Filtering techniques; the method uses discrete time model based on a set of non-linear differential equations describing the system that is linearized about the current operating point; the system can be described by a set of finite difference equations with discrete time varying coefficients; (**Shah et al.,** U. S. Patent 6,285,971); and

(3) a way of representing and analyzing model predictive controllers based on continuous step response of the system using parametric form representation; representing the unconstrained MPC strategy in state space representation; the state space representation allows using extensive library of methods and results for analysis of the MP controllers. (**De Gouvea et al.,** "ROSSMPC : A new way of representing and analyzing predictive controllers", Inst. of Chemical Engineers, 1997).

4.1 Applicant's first set of claims consists of Claim 36.

Independent 36 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"linearizing said updated nonlinear model when a change in said one or more of said model variables has exceeded an associated predetermined threshold".

The closest prior art fails to teach or fairly suggest linearizing said updated nonlinear model when a change in said one or more of said model variables has exceeded an associated predetermined threshold, as claimed by the Applicants. Therefore, Claim 36 is deemed novel and allowable.

4.2 Applicant's first set of claims consists of Claim 37.

Independent 37 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"said updated nonlinear model is linearized when one or more model prediction errors in said MPC format model currently operational in said model predictive controller has exceeded an associated predetermined threshold".

The closest prior art fails to teach or fairly suggest that said updated nonlinear model is linearized when one or more model prediction errors in said MPC format model currently operational in said model predictive controller has exceeded an associated predetermined threshold, as claimed by the Applicants. Therefore, Claim 37 is deemed novel and allowable.

4.3 Applicant's first set of claims consists of Claim 38.

Independent 38 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"linearizing said updated nonlinear model when a change in said one or more of said model variables has exceeded an associated predetermined threshold".

The closest prior art fails to teach or fairly suggest linearizing said updated nonlinear model when a change in said one or more of said model variables has exceeded an associated predetermined threshold, as claimed by the Applicants. Therefore, Claim 38 is deemed novel and allowable.

4.4 Applicant's first set of claims consists of Claim 39.

Independent 39 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"linearizing said updated nonlinear model when a change in said one or more model prediction errors in said MPC format model currently operational in a model predictive controller has exceeded an associated predetermined threshold".

The closest prior art fails to teach or fairly suggest linearizing said updated nonlinear model when a change in said one or more model prediction errors in said MPC format model

currently operational in a model predictive controller has exceeded an associated predetermined threshold, as claimed by the Applicants. Therefore, Claim 39 is deemed novel and allowable.

4.5 Applicant's first set of claims consists of Claim 40.

Independent 40 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"linearizing said updated nonlinear model when a change in said one or more of said model variables has exceeded an associated predetermined threshold".

The closest prior art fails to teach or fairly suggest linearizing said updated nonlinear model when a change in said one or more of said model variables has exceeded an associated predetermined threshold, as claimed by the Applicants. Therefore, Claim 40 is deemed novel and allowable.

4.6 Applicant's first set of claims consists of Claim 41.

Independent 41 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"linearizing said updated nonlinear model when a change in said one or more model prediction errors in said MPC format model currently operational in a model predictive controller has exceeded an associated predetermined threshold".

The closest prior art fails to teach or fairly suggest linearizing said updated nonlinear model when a change in said one or more model prediction errors in said MPC format model currently operational in a model predictive controller has exceeded an associated predetermined threshold, as claimed by the Applicants. Therefore, Claim 41 is deemed novel and allowable.

4.7 Applicant's first set of claims consists of Claim 42.

Independent 42 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in said one or more of said updated submodel variables has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers".

The closest prior art fails to teach or fairly suggest converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in said one or more of said updated submodel variables has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers, as claimed by the Applicants. Therefore, Claim 42 is deemed novel and allowable.

4.8 Applicant's first set of claims consists of Claim 43.

Independent 43 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in one or more model prediction errors in an associated one of one or more MPC format submodels currently operational in an associated one of said two or more model predictive controllers has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers".

The closest prior art fails to teach or fairly suggest converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in one or more model prediction errors in an associated one of one or more MPC format submodels currently operational in an associated one of said two or more model predictive controllers has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers, as claimed by the Applicants. Therefore, Claim 43 is deemed novel and allowable.

4.9 Applicant's first set of claims consists of Claim 44.

Independent 44 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in said one or more of said updated submodel variables has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers".

The closest prior art fails to teach or fairly suggest converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in said one or more of said updated submodel variables has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers, as claimed by the Applicants. Therefore, Claim 44 is deemed novel and allowable.

4.10 Applicant's first set of claims consists of Claim 45.

Independent 45 is directed to a method for controlling a process. The claim identifies the uniquely distinct feature of:

"converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in one or more model prediction errors in an associated one of one or more MPC format submodels currently operational in an associated one of said two or more model predictive controllers has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers".

The closest prior art fails to teach or fairly suggest converting at least one updated submodel of said updated nonlinear model to a linear submodel when a change in one or more model prediction errors in an associated one of one or more MPC format submodels currently operational in an associated one of said two or more model predictive controllers has exceeded a predetermined threshold, said linear submodel for operating said associated one of said two or more controllers, as claimed by the Applicants. Therefore, Claim 45 is deemed novel and allowable.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is 703-305-0043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska, can be reached on (703) 305-9704. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-9600.

K. Thangavelu
Art Unit 2123
August 13, 2004

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER